thin sections could be routinely produced and use of electron microscopy for studying cells exploded. Bretschneider (1952) reviewed thirty-seven articles published since 1950, and a year later Dalton identified twenty-five additional ones, providing a sense of how quickly the field took off once thin sections could be prepared.

Because the use of microtomes to prepare specimens for light microscopy was an established practice, and looking at slices of tissues was not itself problematic, once adequate microtomes were available, they generated few epistemic concerns. Distortions due, for example, to tearing by the knife edge could usually be readily recognized in the resulting micrograph. There were, though, concerns about how to interpret the structures seen in thin-section micrographs. These issues arose especially in the context of the endoplasmic reticulum, which I will discuss in Chapter 6. Before the breakthrough in developing thin sections for electron microscopy, though, important results had already been achieved with the electron microscope using the third technique, tissue culturing of cells.

(c) GROWING TISSUES IN CULTURE. The third approach to preparing thin specimens drew upon a technique developed for a very different purpose – the growing of cells in culture. Ross Granville Harrison developed and Alexis Carrel further refined this technique to allow observers to track cell development. Tissue culture involves taking small pieces of an embryo and placing it in a medium of plasma and embryonic juice. To prepare the cultured specimen for microscopy it is deposited on a coverglass, inverted onto a slide that allows for excavation, and sealed with paraffin. In this environment, cells can grow and their development can be observed. Porter, working in Claude's laboratory, was teaching himself tissue culture techniques to provide material into which Claude could insert particles he was isolating by fractionation to test whether they would affect cell development. Porter recognized that tissue culturing provided specimens sufficiently thin for electron microscopy. He commented, "Although not a peer among the microscopists at the time, I was experienced enough to perceive that such diaphanous cells might be suitable for electron microscopy, at least in their thinner margins" (Porter, 1987).

The technique Porter developed for preparing tissue-cultured cells for electron microscopy was demanding. Cells are selected under a light microscope and

> an area of the film surrounding these, a little larger than the mesh disc, is marked out. This area of film is then cut from the surrounding film with a fine sharp instrument or a pair of watchmaker's forceps. Thus freed, the bit of film with